PEACE/WILLISTON
FISH & WILDLIFE
COMPENSATION
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A Reconnaissance Survey Of Lafferty Lake

M. J. Hunter
March 1997

PWFWCP Report No. 161

105-02071/

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9

Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

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A RECONNAISSANCE SURVEY OF

UNNAMED LAKE (LAFFERTY LAKE)

WATERSHED:	**Williston Reservoir (Finlay Reach)**
DATE OF SURVEY:	**September 11 -12,1996**
FIELD CREW LEADER:	**Mark Hunter**
FIELD ASSISTANT:	**Karin Mathias**
REPORT PREPARED BY:	**Mark Hunter**

BRITISH COLUMBIA CONSERVATION FOUNDATION

PEACE / WILLISTON FISH AND WILDLIFE COMPENSATION PROGRAM

B. C. MINISTRY OF ENVIRONMENT, LANDS AND PARKS

FUNDED BY: FOREST RENEWAL BRITISH COLUMBIA

RELEASED BY: _____

D. J. Cadden, Regional Fisheries Biologist

LAKE: Lafferty Lake **SYSTEM NAME: Lafferty Creek**

A.S.A.P. REFERENCE NO.: **WATERSHED CODE: 230-9583-544**

DATA ON FILE FOR THIS SURVEY

Location	X	Dissolved 02 / Temp. Profiles	X
Physical Data	X	Winter Dissolved 02 / Temp. Profiles	--
Bench Mark	X	Netting Record	X
Terrain Features	X	Lake Catch Summary	X
Access	X	Individual Fish Data	X
Resorts and Campsites	X	Fish Preserved	--
Other Developments	X	Stomach Analysis	X
Obstructions and Pollutions	X	Scale Reading	X
Special Restrictions	X	Location of Inventory Sites	X
Aquatic Plants	X	Photograph Directory	X
Wildlife Observations	X	Appendices	
Miscellaneous Comments	X	A: Water Chemistry Analysis	X
Lake Drainage	X	B: Tributary Stream Data	X
Fisheries Management Comments	X	C: Fish Scale Analysis	X
History of Previous Surveys	X	Bathymetric Map Reduction	X
Water Chemistry Summary	X	Bathymetric Map	--

LOCATION

Location:	approximately 151 km north-northwest of Mackenzie		
Elevation:	925 m ± 25 m	U.T.M.:	10.422779.6262453
Latitude / Longitude:	56°30'01" 124'15'16"	N.T.S. Map No.:	94 - C / 8 & C / 9
Management Unit:	7-37	Biogeoclimatic Zone:	Sub-Boreal Spruce
Ecoprovince:	Northern Boreal Mountains	Ecoregion:	Central Canadian Rocky Mountains
Ecosection:	Misinchinka Ranges		

Drainage: Unnamed C. --> Unnamed C. --> Lafferty C. --> Williston Reservoir (Lafferty Arm - Finlay Reach) --> Peace **R.**

PHYSICAL DATA

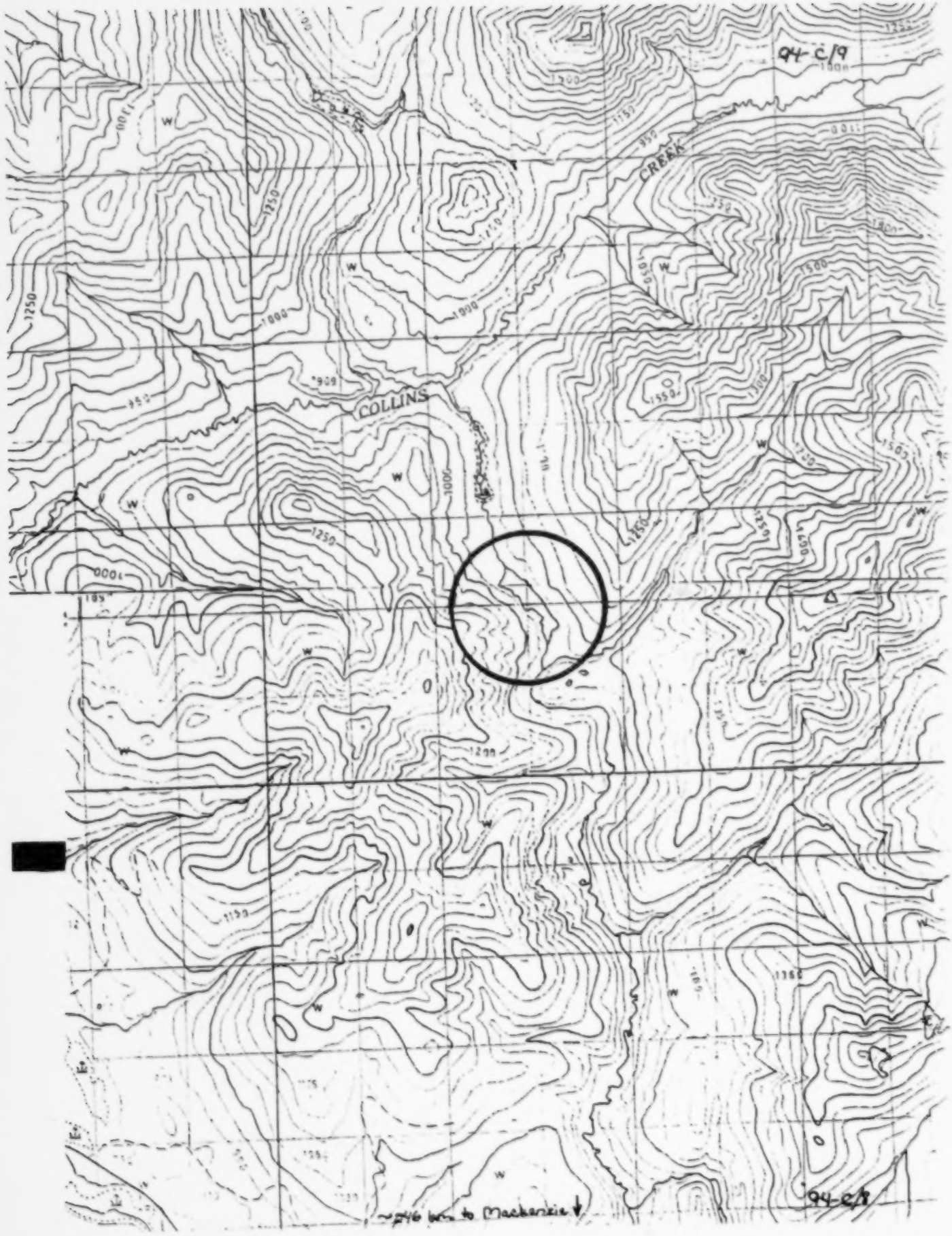
Lake Drainage Area:	2.6 km^2	Volume:	303 442 m^3
Water Surface Area:	149 335 m^2	Perimeter of Islands:	0 m
Area Above 6 m Contour:	146 885 m^2	Number of Islands:	0
Shoreline Perimeter:	2 505 m	Mean Depth:	2.1 m
Maximum Depth:	6.4 m	Secchi Reading:	4.5 m
Filterable Residue (TDS):	70 mg/L		

Sounding Device: Lowrance X-15 Elevation Source: Contour Interpolation

BENCHMARK

(Iron spike, center of red circle) located 2.0 m above present water level in a 15 cm diameter lodgepole pine tree that is 2.2 m from the present water's edge and located on the southwest shore approximately 200 m west of the main outlet (Plate # 4).

High Water Mark: 0.13 m above water level at time of survey


94-C/9
CREEK
COLLINS
94-C/8
~246 km to Mackenzie

LAKE: Lafferty Lake

TERRAIN FEATURES

Immediate Shoreline:

The northeast side of Lafferty Lake is fronted by a growth of sedge grasses and willows with lodgepole pine, fir and spruce trees growing behind on very steep slopes. There is a small sedge grass marsh located on the northeast side of the lake near the outlet. Along the southwest side of the lake, the shoreline is fronted by a growth of sedge grasses and alders with fir trees and some lodgepole pine trees growing behind on very steep slopes. There are a few places along the northeast and southwest shorelines where bedrock outcroppings of shale are found. The northwest end of the lake is fronted by a sedge grass and alder marsh with fir trees and lodgepole pine trees growing behind on low slopes. The southeast end of the lake is fronted by a drier sedge grass marsh with alders growing back from the lake.

The shoreline substrate along the northeast and southwest sides of the lake is composed of a 0.5 m strip of gravels and some cobbles with silts and organics beginning approximately 0.5 m from the shoreline; there is some large woody debris along the shoreline as well. The lake's bottom has a moderate slope towards the center of the lake along these sides. The shoreline substrate in the northwest and southeast ends of Lafferty Lake is composed of silts and organics with some large woody debris. There is a vertical drop off from the edge of the marsh in the northwest end to the lake's bottom; the lake's bottom then has a low slope towards the center of the lake.

There is a beaver hut located approximately half-way along the southwest side of the lake.

Surrounding Country:

Lafferty Lake is surround by a mature forest of fir and spruce trees with some deciduous trees intermixed (mostly to the southwest). To the northeast and southwest, the land rises away steeply to large rolling hills. To the southeast and northwest, the terrain is relatively flat and drops slowly away. Clear cuts are located northeast and west of the lake. Lafferty Lake is situated within the Sub-Boreal Spruce biogeoclimatic zone.

LAKE: Lafferty Lake

ACCESS

Directions:

From the junction of the Finlay-Davis Forest Service Road and the Finlay-Ospika Forest Service Road (just north of Ospika Camp - operated by Timber West Forest Ltd.), drive for approximately 40 km on the Finlay-Davis Forest Service Road, then turn right on to the Collins Mainline. Proceed for approximately 9.7 km, then turn right on to the C 5,000 Road, and drive for approximately 7.0 km to the second clear cut. Lafferty Lake is located approximately 300 m southwest of the road; however, it is easier to use a helicopter to sling gear in to the lake due to the steep slope of the hill that leads down to the lake, and the density of the forest on that slope.

This area has no direct access by road. To reach Ospika Camp, the truck and gear must be barged up out of Mackenzie by Finlay Navigation Inc. They can be reached at (250) 964-3525 in Prince George or at (250) 997-3525 in Mackenzie. The crew must be flown up on one of the local airlines as no passengers are allowed to travel on the barge. At the time of the survey, the barge left Mackenzie on Tuesday and Friday at approximately 1800 hrs, and docked at the Ospika Landing (located approximately 1.0 km south of Ospika Camp) at approximately 0200 hrs the next morning.

Road Type and Conditions:

The Finlay-Davis Forest Service Road and Collins Mainline are both well-maintained, two lane gravel roads that are easily traveled with a two-wheel drive vehicle during the summer. The C 5,000 Road is a one lane, gravel road that can be traveled with a two-wheel drive truck during the summer; a four wheel drive vehicle is recommended if the weather has been wet.

Restrictions:

Although there are no restrictions, it is recommended that a truck radio be used when traveling the gravel roads.

RESORTS AND CAMPSITES

There are no resorts or campsites on Lafferty Lake.

OTHER DEVELOPMENTS

None noted.

LAKE: Lafferty Lake

OBSTRUCTIONS AND POLLUTIONS

None noted.

SPECIAL RESTRICTIONS

None known.

AQUATIC PLANTS

The following aquatic plants were identified during the time of the survey:

sedge grasses
milfoil *(Myriophyllum* sp.)
whitestem pondweed *(Potamogeton praelongus)*
claspingleaf pondweed *(Potamogeton richardsonii)*
water starwort *(Callitrichaceae sp.))*
eel grass
waterweed *(Anacharis sp.)*

WILDLIFE OBSERVATIONS

The following wildlife or signs were seen during the time of the survey:

numerous baby frogs and tadpoles
2 unidentified ducks
unidentified sandpiper
8 Canada geese
belted kingfisher
moose tracks and bones

MISCELLANEOUS COMMENTS

1) The marsh located in the southeast end of Lafferty Lake is a good place for landing a helicopter as it has a firm surface. This is also a good location for camping during the drier months of the year.

2) There is no good location for a year-round Forest Recreation Site on Lafferty Lake due to the steepness of the hills that surround the lake. As well, there is no easy road access to the area. A person either has to be flown from Mackenzie to Ospika Camp and have their truck barged up, or drive down from Fort Ware.

3) Bathymetric map: The lake outline was drawn from an enlargement of air photo 30 BCB 93083: No. 088, flown September 8, 1993.

LAKE: Lafferty Lake

LAKE DRAINAGE

General:

Lafferty Lake is fed by two inlets, one in the northwest corner of the lake, and one on the northeast shore of he lake. An intermittent outlet helps to drain Lafferty Lake to the northwest during periods of high water. The main outlet drains Lafferty Lake to the south, and flows for approximately 0.5 km to join with an unnamed creek, which runs for approximately 3.6 km to its confluence with Lafferty Creek. Lafferty creek runs southwest for approximately 26.6 km to drain into the Finlay Reach of Williston Reservoir.

Major Systems:

There are no major systems.

Minor Systems:

Inlet # 1 - Unnamed Creek

Inlet # 1 enters Lafferty Lake in the northwest corner of the lake (Plate # 5). The creek has an average wetted width of 1.0 m and depth of 0.05 m. The substrate is composed of gravels and small cobble-sized shale with some large cobble located approximately 10 m upstream of the lake. As well, there is lots of woody debris and vegetation on the bottom of the creek bed. Approximately 15 m upstream of Lafferty Lake, there is a small debris jam that would not pose a problem to upstream fish passage. Approximately 20 m upstream of the lake, the creek flows underground. Inlet # 1 had no fisheries potential during the time of the survey.

Inlet # 2 - Unnamed Creek

Inlet # 2 enters Lafferty Lake through the small marsh located on the northeast shore of the lake near the intermittent outlet (Plate # 6). From the mouth of the inlet to 35 m upstream of the lake, the average wetted width is 0.5 m and the average depth is 0.1 m. The substrate is composed of fines (85%) and small gravels (15%). The banks of the creek are covered in sedge grasses and *Equisetum*. Approximately 10 m upstream of the lake, there is a small, 0.1 m high falls created by a log that had fallen into the channel; this falls would not be a barrier to upstream fish passage. From this point on for approximately 10 m, alders grow heavily over the creek. Upstream of 35 m, the substrate is composed of mainly small gravels with some large gravels, and with lots of large woody debris fallen into the channel. The creek has an average wetted width of 0.6 m and depth of 0.05 m. The banks are covered in mosses with grasses, *Equisetum*, Labrador tea and some alders. The gradient increases as well. Approximately 60 m upstream of

LAKE: Lafferty Lake

Lafferty Lake, there are two small falls, 0.1 m and 0.15 m high respectively, that would not hinder upstream fish passage. The channel braids approximately 75 m upstream of the lake. Each braid has an average wetted width of 0.4 m and depth of 0.03 m. From this point on, the channel braids regularly, with the different channels flowing under banks and large woody debris often. The overall channel appears to flow through a slide area, possibly caused by spring melts. There as some possible salmonid spawning habitat located approximately 50 m upstream of Lafferty Lake.

A Stream Survey card was completed for a sample site located approximately 50 m upstream of Lafferty Lake (Plates # 7 & # 8). The average wetted width is 1.0 m and the maximum riffle depth is 0.1 m. The substrate is composed of fines (50%) and gravels (50%). The creek morphology is mainly riffle (80%) with some runs (20%) and a gradient of 4%. The water temperature at the time of the survey was 7 °C. For additional information, refer to Appendix B.

Inlet # 3 - Unnamed Creek

Inlet # 3 enters Lafferty Lake on the northeast shore approximately 100 m southeast of the beaver hut (Plate # 9). The creek has an average wetted width of 0.35 m and depth of 0.15 m. The substrate is composed of large gravel-sized pieces of shale over fines. Over the first 20 m upstream of the lake, the banks are overgrown by sedge grasses and *Equisetum*. Approximately 3 m upstream of the lake, the creek flows under a large log overgrown with moss that did not appear to be passable to fish at the time of the survey. Approximately 20 m upstream of Lafferty Lake, the creek flows under a moss bank that appeared passable to fish at the time of the survey. Upstream of 20 m, devil's club and *Equisetum* grow thickly along the banks. The creek runs down a steep to moderately steep slope, forming many "steps" or small falls. Inlet # 3 had no good fisheries potential during the survey period as the gradient was too steep.

Intermittent Outlet - Unnamed Creek

An intermittent outlet, not flowing at the time of the survey, would partially drain Lafferty Lake to the northwest during periods of high water (Plate # 10). Approximately 50 m downstream of the lake, there is a 0.3 m high dam of earth that the lake would flood over during high water. This dam could be an old beaver dam that has become overgrown.

There is a channel along the front of the dam that has an average wetted width of 2.0 m and depth of 0.3 m. The substrate is composed of silts and organics. The channel runs for approximately 25 m. Near the end of it, an inlet flows into the channel that has an average wetted width of 0.35 m and depth of 0.1 m. This inlet went underground approximately 10 m upstream of the outlet channel at the time of the survey.

A second channel is located on the downstream side of the earth dam that has an average wetted width of 1.5 m and depth of 0.4 m. The substrate is composed of silts and

organics. In some spots along the channel, alders grow heavily over the creek. Approximately 100 m downstream of the lake, there is a beaver dam that is 0.5 m high. No water flowed over the top of the dam at the time of the survey. The intermittent outlet had no fisheries potential during the survey period.

Outlet - Unnamed Creek

The outlet drains Lafferty Lake to the south (Plate # 11). Over the first 60 m of the outlet, the channel has an average wetted width of 5.0 m and depth of 0.4 m. The substrate is composed of silts and organics with some large woody debris in the channel. Approximately 60 m downstream of the lake, there is a 0.5 m high beaver dam that had water flowing through the mid point of it; there is enough room for small fish to be able to move through the dam. Below this dam, the average wetted width decreases to 1.3 m and the average depth is 0.25 m. The substrate is composed of gravels (60%) and fines (40%) with some large woody debris in the channel. The channel is heavily overgrown with alders and sedge grasses. Numerous yearling rainbow trout were seen along this stretch of the outlet during the survey. Approximately 100 m downstream of the lake, the creek widens to form a pond that is approximately 10 m wide and 20 m long. This pond was created by a beaver dam located approximately 120 m downstream of Lafferty Lake. The dam is 0.45 m high, but a partial breach lowered the height difference between the two sides of the dam to 0.25 m. From 120 m to 160 m downstream of the lake, the channel has an average wetted width of 1.5 m and depth of 0.2 m. The substrate is composed of fines (60%) and gravels (40%). Approximately 160 m downstream of Lafferty Lake, a 40 m long and 25 m wide pond has been created by a beaver dam located approximately 200 m downstream of the lake. The dam had been breached on the left side (looking upstream); the result was that the water level was equal on both sides of the dam. Approximately 215 m downstream of the lake, there is a fourth beaver dam that is 0.3 m high and had water flowing over the top in many places; this dam will not pose a problem to upstream fish passage. Downstream of the fourth beaver dam, there are numerous breached beaver dams. The outlet contained locations that would be suitable for salmonid spawning and other locations that would be excellent for rearing.

A Stream Survey card was completed for a sample site located approximately 250 m downstream of Lafferty Lake (Plates # 12 & # 13). The average wetted width is 2.0 m and the average maximum riffle depth is 0.1 m. The substrate is composed of gravels (60%) and fines (40%). The creek morphology is mainly riffles (50%) and runs (35%) with some pools (15%) and a gradient of 3%. The water temperature at the time of the survey was 5 °C. For additional information, refer to Appendix B.

LAKE: Lafferty Lake

FISHERIES MANAGEMENT COMMENTS

Lafferty Lake supports a very large population of rainbow trout that could sustain a moderate to moderately high use fishery. In one experimental monofilament gill net set overnight, 212 rainbow trout were caught. Many had lice on their gills and some had parasites on their stomachs. While this does not make the fish inedible, it does decrease the visual aesthetics of the fish. There appeared to be a large amount of food available to the rainbow trout, such as *Daphnia, Gammerus,* chironomids and caddis fly larvae. There was some salmonid spawning habitat located in the outlet creek, but easier access to these locations could be made by partially removing the beaver dams on the outlet creek.

HISTORY OF PREVIOUS SURVEYS

Lake Surveys:

None known.

Other Related Studies:

None known.

LAKE: Lafferty Lake

WATER CHEMISTRY SUMMARY **Limnology Station No. 1**

Field Conditions:

Date:	September 12, 1996		
Time:	1200 hrs	Air Temperature:	21.0 °C
Wind Velocity:	5 - 7 km/h	Wind Direction:	from the E
Cloud Cover:	8 / 10 o.c.	Surface Conditions:	small waves
Secchi Disc:	4.5 m	Water Colour:	slightly cloudy with light green colour

Method Used:

Dissolved Oxygen:	YSI Model 57 Oxygen / Temperature Meter
Water Temperature:	YSI Model 57 Oxygen / Temperature Meter
Air Temperature:	Hand-Held Alcohol Thermometer
pH (field):	Digital pH Pocket Tester
H2S (field):	Hach H2S Field Test Kit
Laboratory Used:	Pacific Environmental Science Center
Water Sampler:	Vertical Alpha Water Bottle (Vandorn)
Metal Sampler:	By Hand; Preserved With 2.0 mL Nitric Acid
Substrate Sampler:	Substrate Sample Not Taken

Water Sample Chemistry: **SEAM Site No.:** E 223144

	Sampling Depths	
	Surface (0.5 m)	Lower (5.5 m)
Alkalinity (lab)	31.5 mg / L	31.3 mg / L
Filterable Residue 105°C (lab)	70 mg / L	80 mg / L
H2S (field)	N/A	0.0 mg / L
Nitrogen - Total (lab)	0.15 mg / L	0.18 mg / L
Non-Filterable Residue (lab)	< 5 mg / L	< 5 mg / L
pH (field)	8.1	8.2
pH (lab)	7.68	7.63
Phosphorus - Total Dissolved (lab)	< 0.002 mg / L	0.004 mg / L
Specific Conductance (lab)	109 µS / cm	108 µS / cm

Bottom Depth:	6.4 m
Substrate Sample Depth:	N/A

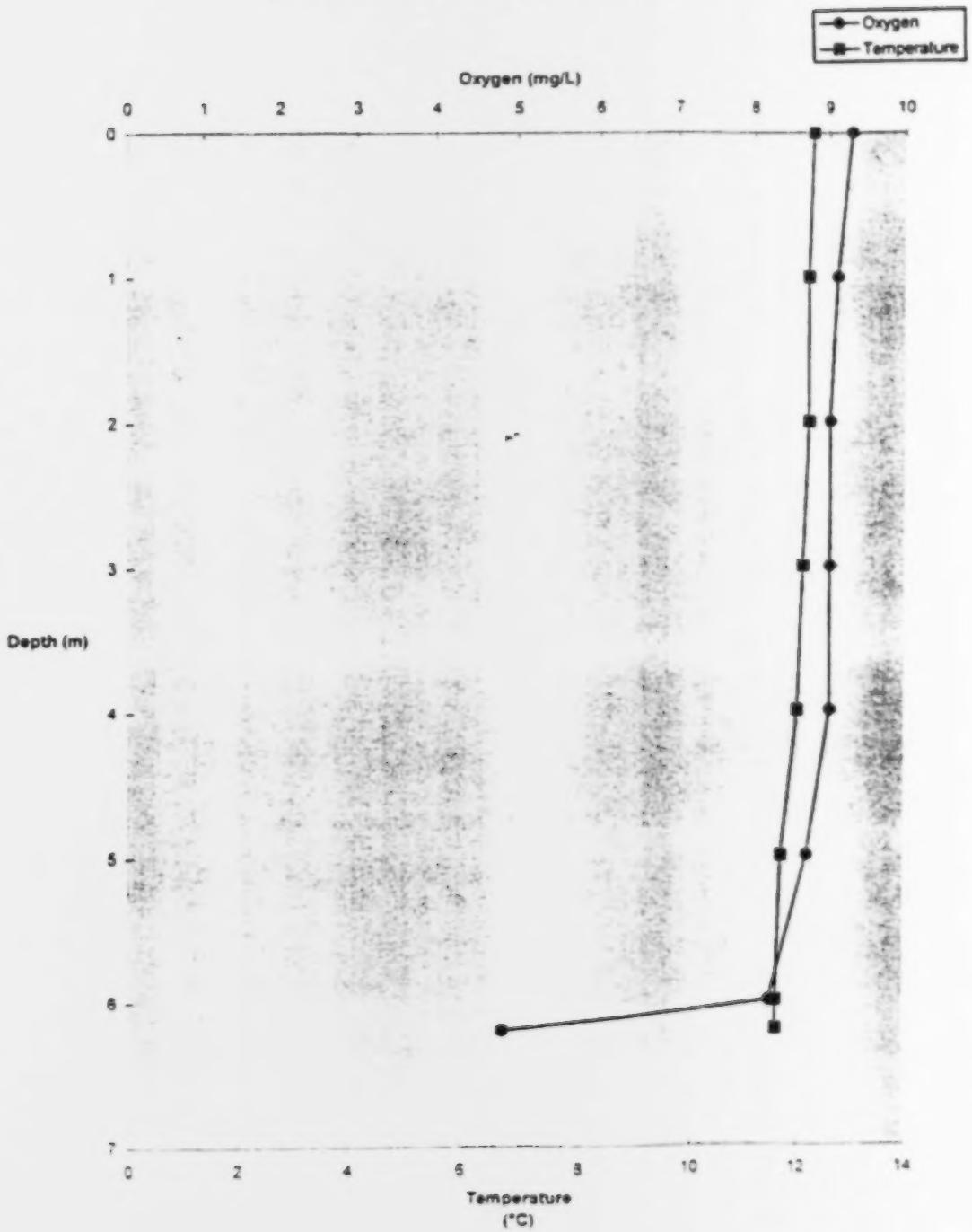
* additional analyzed parameters and results, including metals, are found in Appendix 1

LAKE: Lafferty Lake

SUMMER OXYGEN / TEMPERATURE DATA

DEPTH (m)	02 (mg/L)	TEMPERATURE (°C)
Surface	9.3	12.3
1.0	9.1	12.2
2.0	9.0	12.2
3.0	9.0	12.1
4.0	9.0	12.0
5.0	8.7	11.7
6.0	8.2	11.6
6.2	4.8	11.6
6.4	Bottom	

SUMMER OXYGEN / TEMPERATURE PROFILE



LAKE: Lafferty Lake

NETTING RECORD

Mesh Size Experimental Order: 25, 76, 51, 89, 38, 64 mm

NETTING SITE # 1

Type:	Sinking Monofilament Gill Net			
Date Set:	September 11, 1996		Time:	1915 hrs
Date Lifted:	September 12, 1996		Time:	0905 hrs
Net Dimensions:	Length:	91.4 m	Depth:	2.4 m
Shallow End Mesh Size:	25 mm		Depth:	1.6 m
			Substrate:	silt over gravels
Deep End Mesh Size:	64 mm		Depth:	4.0 m
			Substrate:	silt / organics

Comments: The net started approximately 3.0 m from the lake's edge.

Species	Netting Site No. 1	Angled	Other	Total	Number Sampled	Number Preserved	Size Range (cm)
	212	0	0	212	30	0	10.4-36.0

Minnow Traps:

Bait: Sardines

Trap No.	Hours	Depth (m)	Substrate	Species	No. Caught	Size Range (cm)
1	13:49	0.8	silt / organics with aquatic veg.	RB tadpole	1 1	13.7
2	13:48	1.0	silt / organics with aquatic veg.	empty	0	
3	13:47	0.9	silts over gravel with aquatic veg.	empty	0	
4	13:45	0.7	silts with aquatic vegetation	RB	4	7.0-12.0

LAKE: Lafferty Lake

INDIVIDUAL FISH DATA

Date Captured: September 12, 1996

Method: Sinking
Monofilament
Gillnet

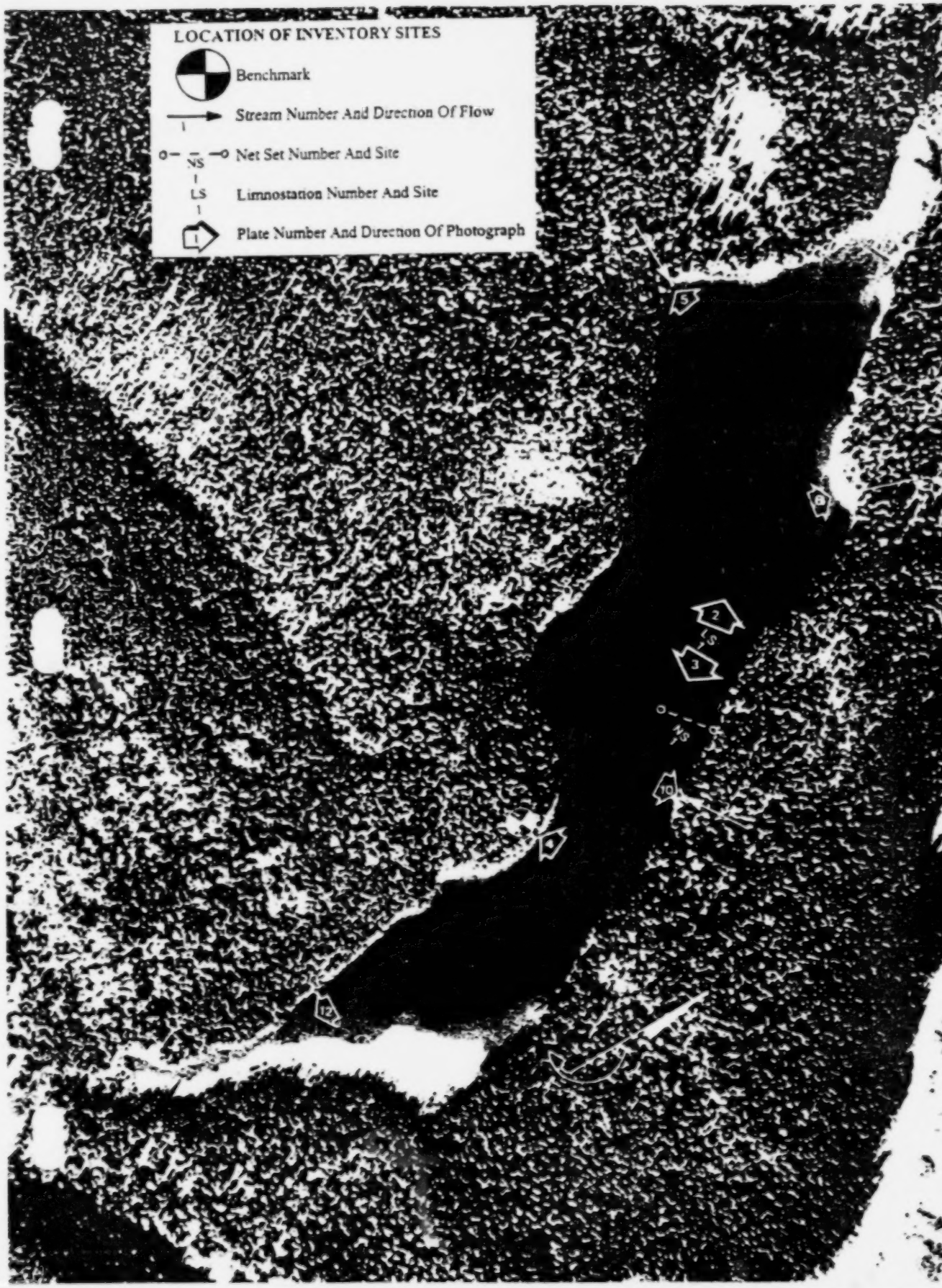
M - Male
F - Female
? - Not Obvious

IMM - Immature
MG - Maturing
MT - Mature
GV - Gravid
SP - Spent
? - Not Obvious

EG - Egg
FR - Fin Ray
HD - Head
ML - Milt
OT - Otolith
SC - Scale

Species	Fork Length (cm)	Weight (grams)	Sex	Gonadal Maturity	Sample Type	Age (yr)	Stomach Contents				Comments
							Plankton	Insects	Fish	Other	
RB	14.7	33	M	IMM	SC	1+	Da	B			Li on gills
RB	13.6	25	M	IMM	SC	2+				empty	
RB	14.3	32	M	IMM	SC	1+				empty	
RB	17.0	53	M	IMM	SC	2+				empty	Li on gills
RB	12.4	18	M	IMM	SC	1+	G, Cr				
RB	12.2	17	F	IMM	SC	1+				empty	
RB	12.5	21	F	IMM	SC	1+	Cr				
RB	13.6	26	F	IMM	SC	1+	Cr				Li on gills
RB	11.4	14	F	IMM	SC	1+				empty	
RB	10.4	10	M	IMM	SC	2+	G				
RB	25.0	175	F	IMM	SC	3+	Da				P on St
RB	20.9	100	M	MG	SC	2+				empty	Li on gills, P on St
RB	24.8	163	F	MG	SC	2+				empty	Li on gills, P on St
RB	21.8	122	M	MG	SC	2+	G, Cr	CF			Li on gills
RB	22.0	127	M	MG	SC	2+	Da				Li on gills
RB	17.9	65	F	IMM	SC	2+	G				
RB	32.6	356	F	MG	SC	3+				S	Li on gills
RB	33.9	369	M	MG	SC	3+	Da				Li on gills, P on St
RB	34.0	420	F	MG	SC	4+	G			C	Li on gills, P on St
RB	33.9	354	F	MG	SC	4+	G, Cr	CF			
RB	26.5	222	F	MG	SC	3+	Cr				Li on gills
RB	32.0	348	F	MG	SC	3+	G			O	Li on gills, P on St
RB	36.0	447	F	MG	SC	4+				empty	Li on gills, P on St
RB	33.1	366	F	MG	SC	3+	Cr	CF		O	Li on gills
RB	33.6	386	M	MG	SC	3+				O	Li on gills, P on St
RB	35.5	440	F	MG	SC	4+	G, Cr			O	Li on gills, P on St
RB	27.0	240	M	MG	SC	3+	Da				Li on gills
RB	30.6	296	F	MG	SC	3+	Da				Li on gills
RB	29.6	279	F	MG	SC	3+	Da				Li on gills
RB	25.5	199	F	IMM	SC	2+	Da				Li on gills, P on St

B - Beetle
C - Clams
CF - Caddis Fly
Ch - Chaoborus
Cr - Chironomids
Da - *Daphnia*
Di - Diptera
G - *Gammerus*
L - Leech
Li - Lice
O - Organics
P - Parasite
St - Stomach
TP - Tape Worm
WB - Water Boatman
WF - Whole Fish


LOCATION OF INVENTORY SITES
Benchmark
1
Stream Number And Direction Of Flow
NS
Net Set Number And Site
LS
Limnostation Number And Site
1
Plate Number And Direction Of Photograph
5
8
2
LS
3
NS
10
9
12

LAKE: Lafferty Lake

PHOTOGRAPH DIRECTORY

Plate	Roll : Number	Description
1	25: 2	Aerial view of Lafferty Lake looking northwest.
2	26:17 - 19	Panoramic view of Lafferty Lake looking northwest from the center of the lake.
3	26: 14 - 16	Panoramic view of Lafferty Lake looking southeast from the center of the lake.
4	26: 10	View of the benchmark located 2.0 m above present water level in a 15 cm diameter lodgepole pine tree that is 2.2 m from the present water's edge and located on the southwest shore approximately 200 m west of the main outlet.
5	26: 24	View of the mouth of Inlet # 1 where it enters Lafferty Lake in the west corner of the lake.
6	26: 12	View of the mouth of Inlet # 2 where it enters Lafferty Lake on the northeast side of the lake.
7	26: 20	Upstream view of the sample site on Inlet # 2, taken approximately 45 m upstream of Lafferty Lake.
8	26: 21	Downstream view of the sample site on Inlet # 2, taken approximately 55 m upstream of Lafferty Lake.
9	26: 11	View of the mouth of Inlet # 3 where it enters Lafferty Lake on the northeast side of the lake.
10	26: 13	View of the mouth of the intermittent outlet, located in the northwest end of the lake.
11	26: 9	View of the mouth of the outlet, where it drains Lafferty Lake from the south end of the lake.
12	26: 5	Upstream view of the sample site on the outlet, taken approximately 255 m downstream of Lafferty Lake.
13	26: 4	Downstream view of the sample site on the outlet, taken approximately 245 m downstream of Lafferty Lake.

Plate # 1: Aerial view of Lafferty Lake looking northwest.

LAKE: Lafferty Lake

Plate # 2: Panoramic view of Lafferty Lake looking northwest from the center of the lake.

Plate # 4: View of the benchmark located 2.0 m above present water level in a 15 cm diameter lodgepole pine tree that is 2.2 m from the present water's edge and located on the southwest shore approximately 200 m west of the main outlet creek.

Plate # 5: View of the mouth of Inlet # 1 where it enters Lafferty Lake in the west corner of the lake.

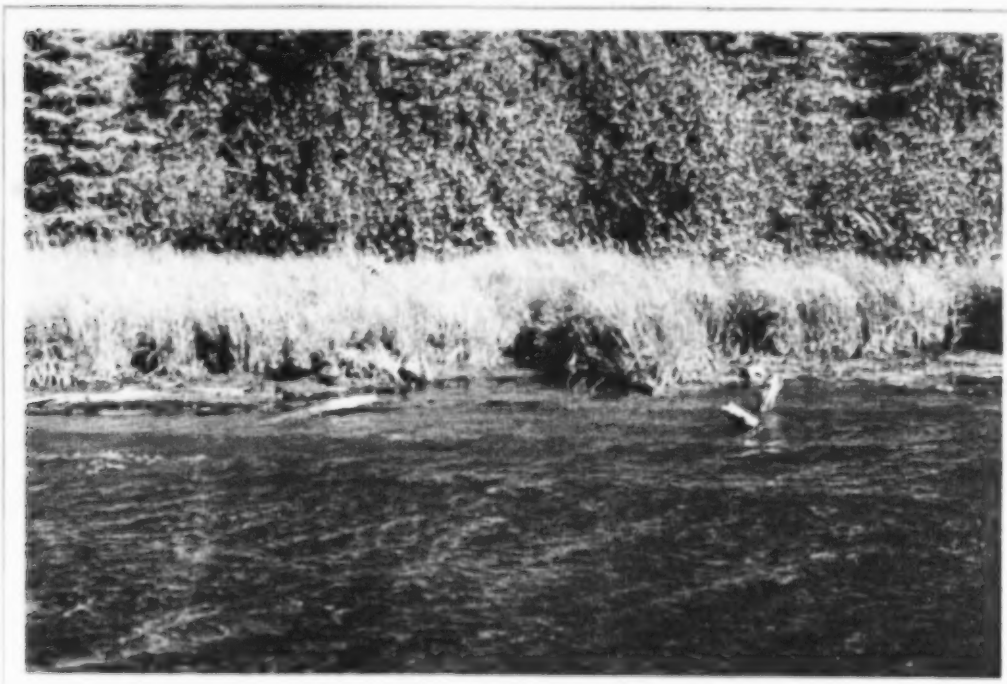


Plate # 6: View of the mouth of Inlet # 2 where it enters Lafferty Lake on the northeast side of the lake.

LAKE: Lafferty Lake

Plate # 7: Upstream view of the sample site on Inlet # 2, taken approximately 45 m upstream of Lafferty Lake.

Plate # 8: Downstream view of the sample site on Inlet # 2, taken approximately 55 m upstream of Lafferty Lake.

LAKE: Lafferty Lake

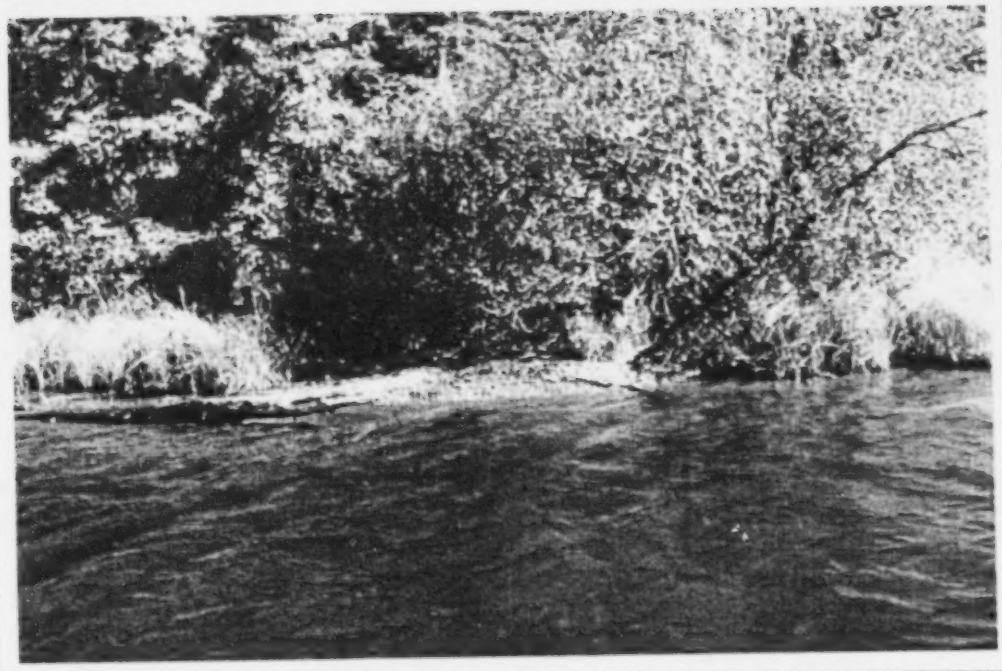


Plate # 9: View of the mouth of Inlet # 3 where it enters Lafferty Lake on the northeast side of the lake.

Plate # 10: View of the mouth of the Intermittent Outlet, located in the northwest end of Lafferty Lake.

LAKE: Lafferty Lake

Plate # 11: View of the mouth of the outlet where it drains Lafferty Lake from the south end of the lake.

Plate # 12: Upstream view of the sample site on the outlet, taken approximately 225 m downstream of Lafferty Lake.

LAKE: Lafferty Lake

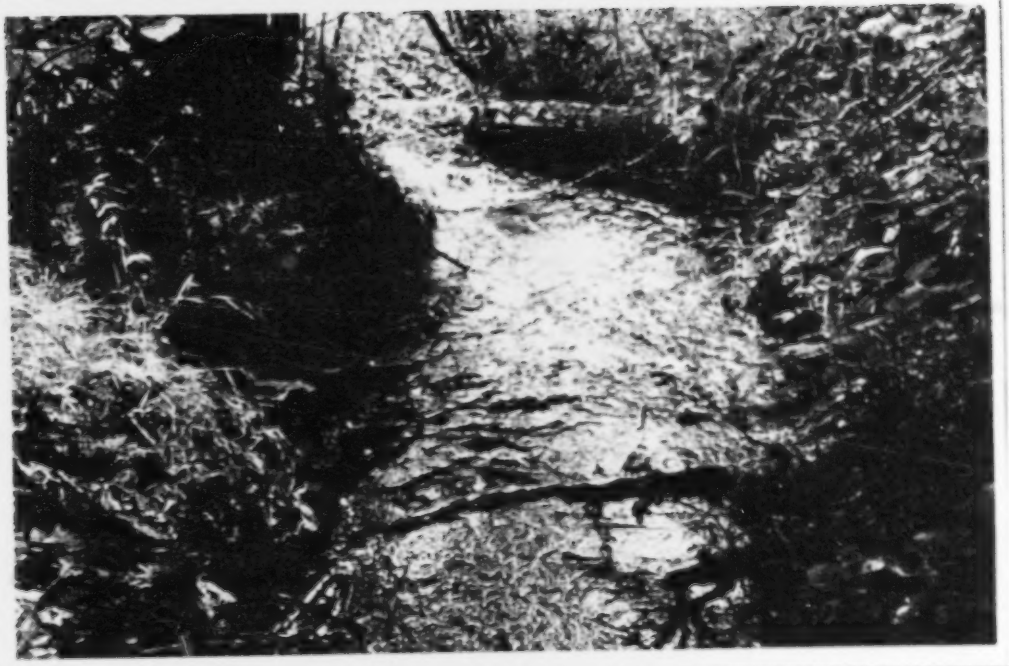


Plate # 13: Downstream view of the sample site on the outlet, taken approximately 245 m downstream of Lafferty Lake.

Appendix A

LABORATORY REPORT

Water Chemistry Analysis

RESULTS FOR UNNAMED LK-COLLINS LK SAMPLES

Parameter Analyzed		Units	964858-001	964858-002
'ALINITY		mg/l	31.5	31.3
ÆUCTIVITY		uS/cm	109	108
METALS/TOTAL (WATER-ICP)	AG	mg/l	<.01	-
	AL	mg/l	<.06	-
	AS	mg/l	<.06	-
	B	mg/l	<.01	-
	BA	mg/l	<.001	-
	BE	mg/l	<.001	-
	CA	mg/l	13.8	-
	CD	mg/l	<.006	-
	CO	mg/l	<.006	-
	CR	mg/l	<.006	-
	CU	mg/l	<.006	-
	FE	mg/l	.148	-
	K	mg/l	.1	-
	MG	mg/l	5.8	-
	MN	mg/l	.035	-
	MO	mg/l	<.01	-
	NA	mg/l	2.1	-
	NI	mg/l	<.02	-
	P	mg/l	<.1	-
	PB	mg/l	<.06	-
	SB	mg/l	<.06	-
	SE	mg/l	<.06	-
	SI	mg/l	3.37	-
	SN	mg/l	<.06	-
	SR	mg/l	.043	-
	TI	mg/l	<.002	-
	V	mg/l	<.01	-
	ZN	mg/l	.003	-
NITROGEN/AMMONIA		mg/l	.008	.01
/NITRITE		mg/l	.004	.003
/NITRITE+NITRATE		mg/l	.002	<.002
/TOTAL		mg/l	.15	.18
PH		Rel.U.	7.68	7.63
PHOSPHORUS/O-PO4		mg/l	.001	.001
/TOTAL		mg/l	.011	.014
/TOTAL DISSOLVED		mg/l	<.002	.004
RESIDUE/FILTERABLE		mg/l	70	80
/NON-FILTERABLE		mg/l	<5	<5
BC CLIENT STUDY CODE			20	20
SAMPLING AGENCY		EMScode	91	91
SITE IDENTIFIER/NUMBER			E223144	E223144
COLLECTION START DATE		y/m/d	96/09/12	96/09/12
UPPER DEPTH		metres	0.5	5.5
TEMPERATURE ON ARRIVAL		deg.C	9	9

Appendix B

Tributary Stream Data

D.F.O. / M.O.E. Stream Survey Form

DFO / MOE
STREAM SURVEY FORM

Stream Name (geo.): Unnamed Ck (local): Inlet #2 to Unnamed Lk | Access | | Method

Watershed Code | Reach No. | Longitude | | |

Location: ~30 m U/S of Unnamed Lk | UMaps | Site No. | Latitude: 10 | |

(Calla: Lk) on Inlet #2 | UTM | Fish Code: Y (N) | Field Sheet: 20 of 20

Date Y M D: 96 019 111 | Time: 1730 | Agency | Crew: MH/KM | Photos | Air Photos

C	PARAMETER	VALUE	METH	SPECIFIC DATA
	Ave. Chan. Width (m)	4.0	ST	5.0 6.0 1.6
	Ave. Wet. Width (m)	1.0	ST	0.8 1.1 0.5
	Ave. Max Riffle Depth (cm)	10	cm	12 12 8
	Ave. Max Pool Depth (cm)	0	cm	
	Gradient %	4	CC	
	% Pool: Q 10 Run 20 Other		GE	
	Side Chan. %	0 (X) 0-5 0-10 >10	GE	
	Debris: Area % 0 (X) 0-5 5-25 >25		GE	
	Debris: Stable %	15	GE	
	COVER: Total %	20	GE	
	Comp Sum 100%	Ub Fluv 0	L Veg 20	Boulder 0	Shrub 10	Tree 50	Undercut 20
	Crown Closure %	35	E	Aspect S

BED MATERIAL		%	C	BANKS
Fines	clay, silt, sand (<2 mm)	50	1	Angle: 90 % Undercut: 60
Gravels	small (2-16 mm)	35		Texture: (F) G L R
	large (16-64 mm)	15		Comment: EN CO FC OC (UC) N/A
Large	small cobble (64-128 mm)	0		Valley Channel Ratio: 0-2 2-5 5-10 (>10) N/A
	large cobble (128-256 mm)	0		Channel Stage: Dry L (M) H Flood
	boulder (>256 mm)	0		Flood Signs (Wrack): (Y) Number: Y (N)
Bedrock (R)		0		Bank Ht. (cm): 10 Ht: Undercut: Diameter:
Dominant: 2	E	Correction: L (M) H		Water Temp °C: 7 Turbidity: Cond. (25°C):

Over 10 m

DISCHARGE

Parameter	Value	Method	Specific Data
Wetted Width (m)	1.0	ST	0.7 1.3 1.6
Mean Depth (m)	0.05	Om	0.04 0.03 0.06 0.05 0
Mean Velocity (m/s)	0.5	Fom	8.9 5.1 5.5 5.2 6.1
Discharge (m³/s)	0.02	Fom	

REACH SYMBOL (Right)

Weight Valley Channel Slope | Bed Material

C	No.	Size Range mm	Use

STREAM/VALLEY CROSS-SECTION (Looking Downstream) ☐

PLANIMETRIC VIEW ☐

L R

COMMENTS

Channel Stability ___ Debris ___ Management Concerns ___ Obstructions ___ Riparian Zone ___ Valley Wall Processes ___ Etc.

1 Fines covered by mud, gravels, Epilobium, Labrador Tea & other

Entered by

Date Y M D

DFO / MOE
STREAM SURVEY FORM

Stream Name (geo.): Unnamed Ck (local): Outlet To Unnamed Lk (Calling Lk) | Access: | Method:

Watershed Code: | Aerial Photo: | Longitude:

Location: ~ 250 m DIS of Unnamed Lk (Calling Lk) | 1:Map#: | UTM: | Site Number: | Latitude: 0m

Fish Card: Y (N) | Field ☒ Office ☐

Date Y M D: 96 | 07 | 12 | Time: 1400 | Agency: | Crew: MH/KDT | Photos: | Air Photos:

C	PARAMETER	VALUE	METH	SPECIFIC DATA
	Ave. Chnl. Width (m)	20	ST	1.3 2.0 1.8 3.0
	Ave. Wet. Width (m)	20	ST	1.3 2.0 1.8 2.5
	Ave Max Riffle Depth (cm)	10	OM	10 14
	Ave Max Pool Depth (cm)	20	OM	R 20 35
	Gradient %	3	SC	
	% Pool: 15 Riffle: 30 Rapids: 35 Other:		GE	
	Side Chan. %		GE	
	Debris: Area %		GE	
	Stable %	20	GE	
	COVER Total %	30	GE	

Canopy Closure 100%	Up Pool	Rip	Rapids	Up veg	Chan veg	Undercuts
	35	30	0	0	5	30

Crown Closure % 30 E Aspect S

Over 3.0m

BED MATERIAL

		%	
Fines	dry, silt, sand (<2 mm)	40	40
Gravel	small (2 - 16 mm)	30	30
	large (16 - 64 mm)	30	
Large	sm. cobble (64 - 128 mm)	0	0
	lrg. cobble (128 - 256 mm)	0	
	boulder (>256 mm)	0	0
Bedrock (R)		0	0

Dominant 25 E Composition L (M) H

BANKS

1	Height (m)	0.5	Undercut	60		
	Texture	(F) G L R				
	Contaminant	EN CO PC OC (XC) N/A				
	Valley Channel Ratio	0-2 2-5 5-10 (10+) N/A				
	Stage	Dry L (M) H Flood				
	Flood Signs (Hist.)	0	Potential	Y (N)		
	Flow (%)	5	pH		Turbidity	
	Water Temp (°C)	15	Turbidity		Cond. (25°C)	

DISCHARGE

Parameter	Value	Method	Specific Data
Wetted Width (m)	1.5	ST	1.7 1.7 1.6
Mean Depth (m)	0.05	OM	0.00 0.09 0.06 C.04 0.03
Mean Velocity (m/s)	0.5	Fam	3.8 4.7 4.0
Discharge (m³/s)	0.04	Fam	

REACH SYMBOL (Right)

Weighted Values: Channel Stability | Bed Material

C	Code	No	Size Range (mm)	Cl	Use	Mod

STREAM/VALLEY CROSS-SECTION (Looking Downstream) L R

PLANIMETRIC VIEW

COMMENTS

Channel Stability | Debris | Management Concerns | Obstructions | Riparian Zone | Valley Wall Processes | Etc.

1 undercut banks & areas of erosion. Equipment, debris & other points noted on

Edited by:

Date Y M D:

Appendix C

FISH SCALE ANALYSIS

Age Determination Completed By:

A.M.C. Technical Services Ltd.
Melinda M. Hirst
6809 Phillip Road.
Lantzville, B.C.
VOR 2H0

SEE ORIGINAL COPY

FOR SCALE SAMPLE READINGS

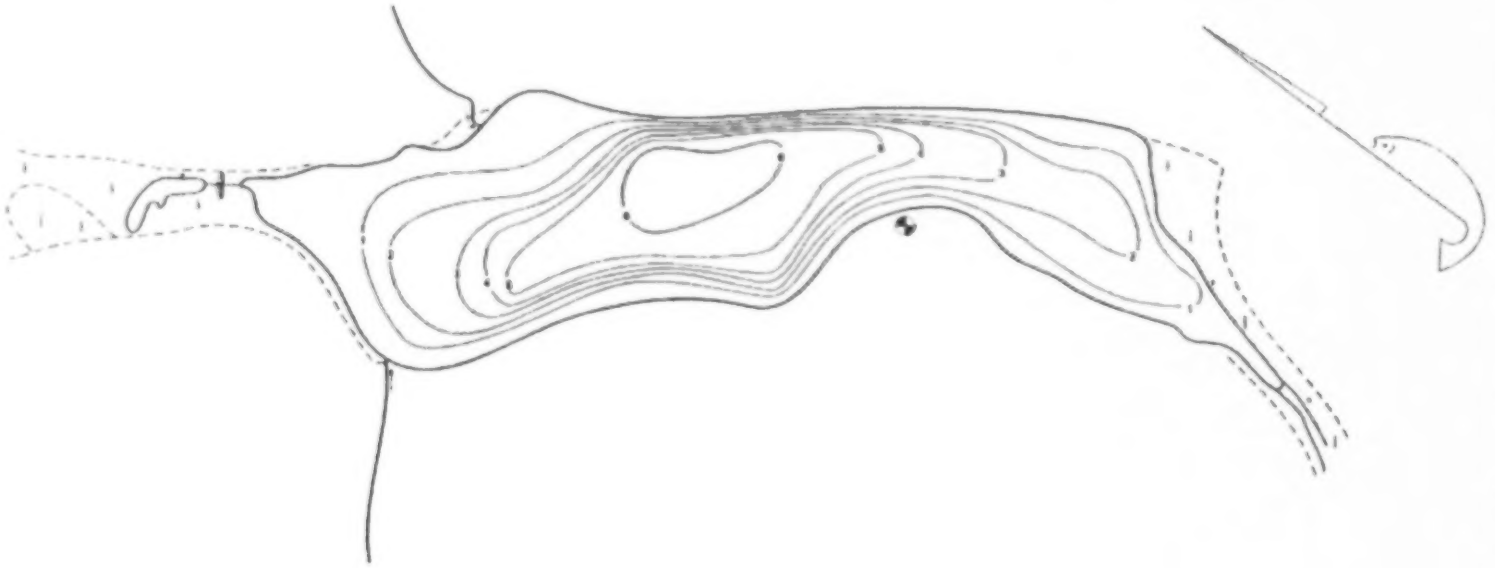
ORIGINAL COPY IS HELD BY

B. C. MINISTRY OF ENVIRONMENT, LANDS AND PARKS

PRINCE GEORGE, B. C.

Appendix D

BATHYMETRIC MAP



Reduced to
34%
of Original Size

STATISTICS AT TIME OF SURVEY

Lafferty Lake